PLANT ITEM MATERIAL SELECTION DATA SHEET

HMP-MLTR-00001 & 2 (HLW)
HLW Melter 1 & 2 Gas Barrier and Cooling Panels

- Design Temperature (°F) (gas barrier/cooling panels): 411/366
- Design Pressure (gas barrier/cooling panels): -100" wc/150 psig

ISSUED BY
RPP-WTP PDC

Contents of this documents are Dangerous Waste Permit affecting

Operating conditions are as stated on sheet 4

Materials Considered:

Material (UNS No.)	Acceptable Material	Unacceptable Material
Carbon Steel		X
304L (S30403)		X
316L (S31603)	X*	
6% Mo (N08367/N08926)		X
Alloy 276 (N10276)	X	
Alloy 22 (N06022)		X
Alloy 690 (N06690)	X	
Ti-2 (R50400)		X

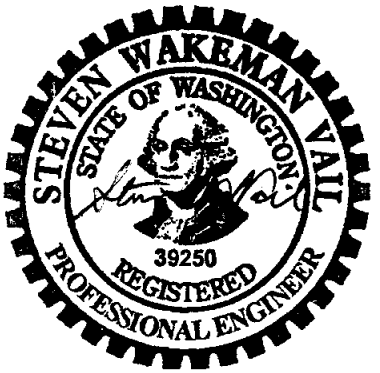
Recommended Material: Containment: Alloy 690 and Alloy 276
Cooling panels within the gas barrier: Alloy 276

*316L is suitable for cooling panels located outside of the gas barrier only

Recommended Corrosion Allowance: 0.00 inch

Process & Operations Limitations:

- None



10/28/05

EXPIRES: 12/07/05

Please note that source, special nuclear and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the U.S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

This bound document contains a total of 4 sheets.

REV	DATE	REASON FOR REVISION	PREPARER	CHECKER	APPROVER
0	10/28/05	Issue for Permitting Use			

PLANT ITEM MATERIAL SELECTION DATA SHEET

Corrosion Considerations:

The HLW melter is "encapsulated" in a mostly Hastelloy® C-276 outer shell with a lid of Inconel® 690, though some air in-leakage is permitted. Within the outer shell are cooling pads constructed of Hastelloy® C-276 (24590-101-TSA-W000-0010-418-01). There is no stainless steel or carbon steel within the gas barrier.

The operating temperatures for HLW components range from approximately 130 °F to 135 °F at the cooling pads to about 411 °F at the lid. The gas compositions for the HOP system are used as a conservative limit. Because the offgas from the melter contains about 27% water, condensation is feasible at these temperatures. The presence of NOx and SOx is expected to result in a condensate at the cooling panels with a pH ≤1.5; some chloride will be present along with fluoride.

a General Corrosion
At the lid temperature of 411 °F, the corrosion is expected to be less than that of the offgas line which is Inconel® 690 and operates at about 1200 °F.

At the cooling panels, the lower temperature and the relatively high chromium content of the alloys is expected to keep the general corrosion rate much less than 1 mpy.

Conclusion:
No significant corrosion is expected. Therefore, no massive loss of containment is expected.

b Pitting Corrosion
At the relatively low pH, estimated at approximately 1.5 in the condensed solution, the halide concentration, which is low in the gas phase, is expected to be relatively low. Nevertheless, there is some concern about the pitting of Inconel® 690 which has no molybdenum; the pitting rate is expected to be small (Special Metals 2002). The Hastelloy® C-276 is expected to be immune from pitting at these temperatures and conditions (Haynes Int'l 1987).

Conclusion:
There is some concern about the pitting of the Inconel® 690. There are no data available to give rates but it is expected that the liner will not have significant penetration in the five years of melter life.

c End Grain Corrosion
Acid concentrations are not sufficiently high to be a concern.

Conclusion:
Not a concern.

d Stress Corrosion Cracking
The high nickel content of the alloys is expected to minimize the probability of cracking.

Conclusion:
Not a significant concern.

e Crevice Corrosion
The concerns are similar to those noted in the pitting section. The main concern is whether there are crevices where condensate can collect.

Conclusion:
Same as the pitting conclusions.

f Corrosion at Welds
Corrosion at welds is not considered a problem in the proposed environment.

Conclusion:
Weld corrosion is not considered a problem under that anticipated operating conditions.

g Microbiologically Induced Corrosion (MIC)
Not a concern for the conditions and materials.

Conclusion:
Not a concern.

h Fatigue/Corrosion Fatigue
Thermal cycles should not be more than a few per day. Therefore, corrosion fatigue is not a concern.

Conclusions
Not a concern.

PLANT ITEM MATERIAL SELECTION DATA SHEET

i Vapor Phase Corrosion
Not a concern, as noted in the general corrosion section.

Conclusion:
Not a concern.

j Erosion
There is no fluid flow.

Conclusion:
Not a concern.

k Galling of Moving Surfaces
No moving surfaces are expected.

Conclusion:
Galling is not a concern.

l Fretting/Wear
No contacting surfaces expected.

Conclusion:
No fretting concern.

m Galvanic Corrosion
There is not a significant potential difference between the alloys.

Conclusion:
Not a concern

n Cavitation
There is no fluid flow.

Conclusion:
Not a concern.

o Creep
The temperatures are too low to have an effect.

Conclusion:
Not a concern.

P Inadvertent Addition of Nitric Acid
There is no practical method of adding nitric acid.

Conclusion:
Not a concern.

PLANT ITEM MATERIAL SELECTION DATA SHEET

References

1. 24590-101-TSA-W000-0010-418-01, *HLW Melter Materials Selection Report.*
2. CCN 120764, e-mail from M Hall to JR Divine, 24 March 2005, "Melter Materials and Operating Conditions."
3. Hastelloy® alloy C-276, 1987, Haynes International, Inc.
4. Inconel alloy 690, 2002, Publication Number SMC-079, Special Metals Corporation

Bibliography

1. Agarwal, DC, *Nickel and Nickel alloys*, In: Revie, WW, 2000. *Uhlig's Corrosion Handbook*, 2nd Edition, Wiley-Interscience, New York, NY 10158
2. Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073
3. Imrich, KJ, *Metallurgical Evaluation of an Inconel 690 Insert from a Radioactive Waste Glass Melter Pour Spout*, Westinghouse Savannah River Company, 1998.
4. Wright, IG, *High-Temperature Oxidation*, In: Davis, JR (Ed), 1987, *Corrosion, Vol 13*, In "Metals Handbook", ASM International, Metals Park, OH 44073

PLANT ITEM MATERIAL SELECTION DATA SHEET

OPERATING CONDITIONS

Materials Selection Data

Component (Name/ID) HMP-MLTR-00001&2 (note 1)

System HMP (HLW Melter Process System)

Chemicals	Unit	Normal Conditions	Maximum Flow Conditions
Oxygen	%	15	14.9
Chlorine	ppmv	trace	trace
Fluorine	ppmv	trace	trace
NO_x	ppmv	1230	6650
Sulfur Dioxide (SO_2)	ppmv	11	9
Ammonia (NH_3)	ppmv	181	436
Carbon Monoxide (CO)	ppmv	80	156
Carbon Dioxide	%	0.7	1.3
Particulate	ppmv	410	361
Hydrochloric Acid (HCl)	ppmv	3.5	26
Hydrofluoric Acid (HF)	ppmv	30	294
Water (H_2O)	%	27.7	27.2
Pressure	mbar	972	971
Temperature (Note 2)	°F		

Note 1: The compositions for the HOP system are used as a conservative limit.

Note 2: Cooling panel temperatures are expected to be the maximum average cooling water temperature. Operating temperature range for HLW panels is 130F to 135F. HLW maximum gas barrier temperature is 411°F at the lid (CCN120764).